Negative Exponents (1-5)

**Zero Power** - any nonzero number to the zero power is 1 (ex: $5^0 = 1$)

**Negative Power** - any nonzero number to a negative power is the multiplicative inverse of its $n^{th}$ power (ex: $7^{-3} = \frac{1}{7} \cdot \frac{1}{7} \cdot \frac{1}{7} = \frac{1}{7^3}$)

**Examples**

1. Write each expression using a positive exponent.

   **Steps** - Write the base with a positive exponent as a fraction with a numerator of 1.

   - $a^{-3} = \frac{1}{a^3}$
   - $b^{-5} = \frac{1}{b^5}$
   - $c^{-6} = \frac{1}{c^6}$
2. Write each fraction as an expression using a negative exponent other than \(-1\).

\(a\) \( \frac{1}{5^2} = 5^{-2} \)

\(b\) \( \frac{1}{3^2} = \frac{1}{6^2} = 6^{-2} \)

\(c\) \( \frac{1}{8^3} = 8^{-3} \)

\(d\) \( \frac{1}{27} = \frac{1}{3^3} = 3^{-3} \)

3. Simplify each expression.

\(a\) \( 5^3 \cdot 5^{-5} \)
- Use Product of Powers rule (add exponents of common bases): \(5^{3+(-5)} = 5^{-2} \)
- Write as a fraction using positive exponents: \( \frac{1}{5^2} \)
- Simplify: \( \frac{1}{5^2} = \frac{1}{5 \cdot 5} = \frac{1}{25} \)
b \( \frac{W^{-1}}{W^{-4}} \)

Use quotient of powers rule (subtract exponents with same base) \( W^{-1-(-4)} = W^{-1+4} = W^3 \)

c \( \frac{3^2}{3^4} \)

\( = 3^{2-4} = 3^{2+(-4)} = 3^{-2} = \frac{1}{3^2} = \frac{1}{9} \)

d \( 3^3 \cdot 3^{-2} \)

\( = 3^{-3+(-2)} = 3^{-5} = \frac{1}{3^5} = \frac{1}{243} \)